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RECENT TRENDS IN TRASH CONTENT OF RAW COTTON CREATE A PROBLEM IN GRADE STANDARDS

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In judging cotton quality, a visual examination of samples by a trained cotton classer has for many years been the chief method of judging the amount and kind of trash to be expected in a bale. Trash content is one of three factors—color, leaf-and-trash, and preparation—that he takes into consideration in judging grade. And grade, in turn, is but one of several judgments he makes in assessing the quality of a bale as a basis for purchase.

Good ginning practices can maintain good preparation and can remove much leaf and trash, but can do nothing to improve lint color once it is lost. Lint color is at its peak when well matured bolls open in good weather, and any change from this peak color, whether by premature opening by frost, freeze, or heat, by insect damage, or by exposure to weather after opening, will cause a deterioration in color, and consequently in grade.

For years grade standards have aided a cotton man to make consistent appraisals for color, trash content, and preparation. Until recently, the relation of these factors in most cottons the classer looked at, was about the same as it was in the standards. But this is no longer true, for while the trash content of the standards remains unchanged, more trash is now being removed than in earlier years. This means that the relation of color, trash, and preparation in cottons of current crops is no longer the same as it was only a decade ago before the requirements of mechanical harvesting led to an increasing use of lint cleaning equipment that has jumped from 28 gins in 1948 to about 400 in 1950, 3,500 in 1957, and over 5,000 by 1961, which is 90 percent of the 5,619 gins reported in the United States.

The separate factors are each as important today in indicating cotton quality as they were yesterday, but their relation, as they must be fitted into a single judgment of "grade," makes the grades of yesterday and of today seem different. It is as if we were grading boxes in terms of cubic content: a box with a capacity of 216 cubic inches could be packed with the same amount of loose powder regardless of dimensions, but if 12-inch merchandise is to be packed into this box, its separate dimensions must be specified to allow it. So with cotton. Combinations of color, trash, and preparation in a given grade have remained reasonably consistent for so long that one is tempted to forget that each factor provides for a separate quality element. More will be said later about the relationships of these separate factors, but let us first review the history of grade standards, since it is against these standards that the separate factors are measured.

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[1] Based on a report to the 1962 National Cotton Council's Cotton Research Clinic, Pinehurst, North Carolina, January 11, 1962.

The first cotton standards approved by the Department of Agriculture were for nine grades of white cottons developed in 1909 by a committee that consisted of "nine men, prominent in various branches of the cotton trade," with three experienced classers from the New York, New Orleans, and Dallas markets. These were wholly voluntary standards and their use never became widespread. But in 1914, under authority of the Cotton Futures Act new grades, prepared on the basis of these and of the Liverpool-upland standards, were adopted as "official cotton standards of the United States." [2] Only the futures exchanges were obliged to use these standards, but all important spot exchanges adopted them voluntarily. In 1916 standards for yellow tinged, yellow stained, and blue stained grades were added to the white grades.

These standards remained in effect without change until July 1922, effective 1923, when certain changes were made—a few in the white grades, the yellow tinges made lighter in color, and descriptive standards adopted for colors between those for which practical forms were available. An averaging rule for factors embracing more than one grade was made a part of the official cotton standards. It now provides, [3] among other things, "That in no event shall the grade assigned to any cotton or sample be more than one grade higher than the grade classification of the color or leaf contained therein."

Passage of the Cotton Standards Act in 1923 made use of these standards mandatory, for in connection with transactions or shipments in commerce it became unlawful to use any grade name or designation not used in these standards, excepting only transactions based on actual samples or private types. In 1924, after discussion and conferences with representatives of the American trade and European exchanges, these United States official grade standards, by formal agreement with European exchanges, became known also as Universal Standards for American upland cotton. All copies were to be prepared by the Department of Agriculture and, under a supplemental agreement, provision was made for holding periodic conferences for the sole purpose of examination and approval of sets of copies of the original Universal standards for use in the United States and by member associations. The first conference under the supplemental agreement was held in Washington, March 1925, and conferences were held biennially through 1933.

In 1935, effective 1936, a general revision was made, chiefly on account of color. In 1939 there was a conference. Then, because of World War II, none was held until 1946 when again the standards had to be changed because

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[2] An interesting report regarding these standards, the development of specially lighted rooms for preparing copies, and of other safeguards for their maintenance, is contained in United States Department of Agriculture Service and Regulatory Announcement No. 6, 1916.

[3] See Federal Register, June 25, 1959, Sec. 28.480.

of color change that occurred in the seven year interval between conferences. The standards adopted in 1946 were approved by all segments of the trade except the American manufacturers who objected that by comparison to copies of the old standards they were whiter, less desirable, and lower value.

The next conference was held in 1950. At that time physical standards were requested for spotted and gray cottons. For this reason, and because the manufacturers reiterated their position that the standards had been lowered in 1946, the Department agreed to make a new survey of the crop. By that time the development of a rapid automatic cotton colorimeter made it possible to measure not only every bale but every sample in both the survey and standards. No evidence was found that standards had been lowered in 1946, but there was now so much information available as a result of the survey, both by color and trash measurements, that standards were revised in 1952, effective 1953, to "reflect the characteristics of recent cotton crops, insofar as color, leaf, and preparation are concerned." It is these standards, [4] plus a Good Middling adopted in 1954, and the addition of Spotted grades, and a redefinition of certain descriptive grades, that are in effect today.

In all of these years a consistent effort has been made to maintain the standards on the level they were when originally established. The principal reason for revisions in 1933, 1946, and 1952 was the change that had taken place in color of the standards. Between conferences the cotton yellowed enough so that as new boxes were made to match the old, a gradual color drift took place that sooner or later made it impossible to find cottons in any new crop that would match the color of cottons in the standards boxes. This was particularly true of grades above Middling, for bales had to be searched out and purchased from stocks of old cottons. Until the revision of 1952, only a partial adjustment was made for this yellowing, for the visual impact of the color in old boxes of standards was an influence on cotton men that was hard to overcome until after development of the automatic cotton colorimeter finally convinced even the most skeptical that accurate and precise color measurements were possible. These measurements showed that the primary cause of the periodic need to change standards was that the cottons used in the standards boxes changed [5] with time. While some of the change was caused by a change in varieties, a few naturally creamy varieties being replaced by white ones, this was not the major cause of the need for a color change in standards, as some cotton men explained it in wishfully hoping for a return of the creamier cottons they preferred. (Not until the 1952 standards was an irrigated bale of cotton, with its "extra white" color, allowed representation in the white grades.)

But in all the years when periodic revisions had to be made in standards on account of color, no intentional change was made in either the level or kind of leaf. In preparing boxes for review at each conference, the leaf was matched, insofar as it was humanly possible, to the leaf in the original standards box for each grade, and checked with photographs and against duplicate boxes passed at previous conferences. This matching of leaf, and hand smoothing and combing of samples to obtain good preparation, finally resulted in such artificial looking samples that in the 1953 revision it was agreed that natural samples would be used, particularly in the higher grades, these to be taken directly from the bale with as little manipulation as possible.

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[4] See D. Nickerson, COLOR MEASUREMENTS OF COTTON....Including a Discussion of Recent Work on Standards for Grade, 38 pp., March 1953, and COLOR OF GRADE STANDARDS, 1909-54, 15 pp., April 1954, obtainable from Cotton Division, A.M.S., U. S. Dept. of Agriculture, Washington 25, D. C.

[5] The rate of this color change, we now know, depends upon conditions of temperature and humidity during storage.

Although no intentional change was made in the level of trash content, there was much discussion in 1946 that indicated a belief on the part of some that the amount of trash in the 1946 standards had been increased for some or all of the grades. In those years color measurements, but no trash measurements, were made on standards bales—all comparisons for trash were made visually by the classer. Therefore, to check whether any inadvertent change had been made in trash content, Shirley Analyzer measurements were made after the conference on samples of bales used in the 1946 standards, and comparisons were made to measurements already in our files for the 1936 bales.

The results in table 1, reported in Textile Research Journal, April 1950, show good agreement between trash measurements for 1936 and 1946 standards bales. A smoothed curve drawn through these data provided specifications for a regularly stepped scale for trash content in future standards. This scale was used in purchasing bales for the 1953 revision of standards.

Table 1.--Percentage nonlint in bales used in cotton grade standards

White grades	Shirley Analyzer percent nonlint				
	1936 standards bales		1946 standards bales		Smoothed curve
No.	Av.	S.D.	Av.	S.D.	
2			2.26	±0.26	2.0
3	2.94	±0.83	2.38	±0.29	2.4
4	3.63	±0.44	3.51	±0.67	2.9
5	3.83	±0.45	3.69	±0.15	3.7
6	5.35	±0.73	5.12	±1.32	5.1
7	8.08	±1.37	7.71	±1.74	7.6
8	11.03	±2.25	11.25	±1.44	11.0
9	18.64	±4.13	15.17	±4.20	17.0

At the 1956 conference, boxes were passed against the 1953 standards. By 1959 we knew that much less leaf was beginning to appear in current grades, and the Department prepared and showed to the domestic industry in a series of local meetings held prior to the next conference a set of grade survey boxes that showed this. This set of boxes, based on a survey of the 1958 crop was shown to the 1959 Universal Grade Standards Conference as a basis for discussing a revision of the standards, particularly of leaf content. But the conference, except for the shippers, was not willing to consider a change.

With no change in standards since the revision of 1953, and in light of the foregoing history, which indicates no intentional change in trash level at any previous conference, it should be clear that the trash content required in today's grade standards remains essentially on the level originally adopted in 1924.

Let us now take a look at methods of judging trash content. The first and still most widely used method is visual judgment against a standard. To help keep standards constant, reference is made not only to original sets of cottons but also to photographs which for many years have supplied a record of the foreign matter content in all copies of the standards. Each box is photographed immediately after its approval by a review committee, and a copy of the photograph is placed in the cover of the corresponding box. But while this provides a record, and a means for comparison, it is not a very useful or satisfactory method, nor does it provide a way to report statistically any measure of trash content.

Since the middle 1930's the Shirley Analyzer has been used to measure the trash content of cotton. It makes an almost complete separation of cotton lint and trash with a minimum of fiber loss. After separation of lint and trash in 100 gram samples, the weight of lint fed into, and delivered from the machine, the weight of visible foreign matter, and of invisible losses, are used as a basis for calculating the percentage of nonlint content. While these weight figures do not take into consideration the nature of the trash, nevertheless they provide the best measure available in the last 25 years for measuring trash content. Another method of trash measurement uses a trashmeter that scans the surface of a sample. Such an instrument is now in use in our Washington laboratories, but measurements made on it do not go back far enough to provide comparative figures for purposes of the present study. We also have measurements of the picker and card waste removed in manufacturing that will be discussed later.

Simple correlations of trash measurements by several methods are shown in table 2. These vary for grade standards bales from r = 0.94 to 0.98. Similar correlations, based on medium staple white cottons in the 1960 Annual Quality Survey, show relationships about 0.70. While the level is higher in one case than the other (because of the narrower range of grades in the 1960 survey), nevertheless both studies indicate that the Shirley Analyzer is as good a means for measuring trash as any now at our disposal.

Table 2.--Trash measurement correlations (r)

	Classer's grade (index)	Shirley Analyzer by weight	Trashmeter		Picker and card waste
			Area	Count	
	(r)	(r)	(r)	(r)	(r)
	Based on standards bales				
Picker and card	-0.94	+0.98	---	---	---
Classer's grade	---	-0.96	---	---	-0.94
Shirley Analyzer	-0.96	---	---	---	+0.98
	Based on 1960 Annual Quality Survey				
Picker and card	-0.69	+0.70	+0.52	+0.54	---
Classer's grade	---	-0.70	-0.70	-0.73	-0.69
Shirley Analyzer	-0.70	---	+0.65	+0.58	-0.70

With this background, now let us examine Shirley Analyzer measurements of trash content made over a period of many years on three separate type studies: on bales purchased for use in preparing copies of grade standards and guides; on grade survey samples for years in which special trash surveys have been made; and on samples used in cotton quality surveys that have been published annually since 1946. Differences may be expected between these studies. Trash measurements on standards bales should be as close to the levels required for standards as it is possible to find, for only when it is impossible to find bales with separate factors equal to those in the standards are other bales considered. On the other hand, trash survey samples represent the complete range of grades in current crops, regardless of the relation of their grade factors, and while not as many samples have been measured as in the more regularly conducted color surveys (because Shirley Analyzer measurements are slower to make), nevertheless in these special trash surveys several thousand samples have been measured. For the annual quality surveys, samples represent only the modal grades in the crop, therefore trash measurements for these studies do not cover all grades.

Trash analyses by Shirley Analyzer percent nonlint content, for white grades, 1936-61, are shown for all three studies in table 3. These analyses make it clear that there is much less trash content in grades of current crops than in those of earlier years. Figure 1, based on data in table 1, shows the average nonlint in standards bales of 1936 and 1946. Figure 2 is based on trash content for grades measured in 1958, 1959, and 1960, shown against the standards curve of figure 1. A comparison of figures 1 and 2 will indicate the relative amount of the decrease in trash content in recent years. 6/ In 1960, in the higher grades there was not much more than half as much trash, by weight, as in samples of the same grades 15 to 25 years ago. Compared to the target curve, grades below Low Middling have leaf about one grade less than formerly, Low Middling about 1.5 grades, Strict Low Middling almost two grades less, and Middling and above even more than two grades. In grades Middling and above a difference by weight of only 1.5 percent trash can mean as much as two grades. Where standards for Good Middling to Good Ordinary vary in trash requirements from 2.4 to 17 percent, today these grades average from 1.4 to 10 percent. In fact, with over 90 percent of the crop equal to or above Low Middling in the white and light spotted grades, this seems to mean that as now ginned, over 90 percent of the crop measures 4.5 percent or less nonlint content. This reduction in trash content seems to have been increasing over the past few years. And preliminary figures, based on a special survey being made this year, indicate that 1961 trash figures will be similar to those for 1960.

6/ More detailed comparisons of these separate studies are made in Report No. 3, "Trash and Color," distributed at the 1959 conference. Copies may be requested from the Cotton Division, Agricultural Marketing Service.

Table 3.--TRASH ANALYSIS: Measured by Shirley Analyzer percent nonlint content, for White grades, 1936-61

Year	SGM 2	GM 3	SM 4	M 5	SLM 6	LM 7	SGO 8	GO 9
	Standard curve based on 1936-46 standards bales, used since 1953 as reference for nonlint in grade standards							
Stds.	2.0	2.4	2.9	3.7	5.1	7.6	11.0	17.0
	Based on bales used in grade standards and guides[1]							
1936[1]		2.9	3.6	3.8	5.4	8.1	11.0	18.6
1946[1]		2.4	3.5	3.7	5.1	7.7	11.2	15.2
1950[1]		2.4	3.1	3.6	4.7	7.6	11.7	13.5
1952-3[1]		1.8	2.7	3.5	5.2	8.1	11.5	15.3
1954[1]		1.7	2.6	3.5	4.5	8.0	11.8	13.0
1955[1]		1.8	2.5	2.8	4.5	7.4	11.3	14.8
1956[1]		1.8	2.3	3.1	4.7	7.3	10.7	13.3
1957[1]		1.9	2.4	3.3	4.5	6.1	7.5	13.6
1958[1]		1.9	2.4	3.1	3.9	5.7	7.6	10.8
1959[1]		1.3	1.9	2.1	3.5	6.0	7.0	10.6
1960[1]		1.7	2.1	2.3	3.6	5.8	9.3	11.5
1961[1]		1.6	1.7	2.2	3.1	4.9	9.1	11.1
	Based on grade survey samples for years in which special trash surveys were made							
1947		3.5	4.0	4.6	5.5	7.8	11.0	15.3
1951	1.6	2.2	2.3	3.2	4.3	6.5	9.8	13.5
1952		2.2	2.3	3.3	4.8	6.8	9.6	12.1
1953		2.1	2.5	3.2	4.6	6.7	10.2	13.4
1958		1.7	1.9	2.3	3.4	4.7	6.6	8.7
1959		1.5	1.6	2.2	3.2	4.6	7.6	10.9
1960		1.0	1.4	2.1	3.3	4.3	7.2	8.6
1961[2]		1.5	1.8	2.2	3.2	4.7	6.1	7.9
	Based on samples used in cotton quality studies published annually since 1946							
1946			4.2	4.2	5.2			
1947			3.2	3.7	4.8	5.8		
1948		3.6	3.7	3.8	4.8	5.9	10.2	
1949		2.6	3.3	3.8	4.7	6.0		
1950			2.6	3.0	4.1	4.9	7.8	
1951			2.5	3.2	3.7	6.6		
1952		1.5	2.6	3.2	4.3	5.9	5.4	
1953		1.3	2.5	3.2	4.1	5.5		
1954		2.2	2.4	3.2	4.0	5.5		
1955			2.4	3.1	3.8	5.7		
1956		1.8	2.3	2.8	3.7	4.6		
1957		1.1	2.1	2.6	3.3	4.7	6.7	
1958			1.9	2.3	2.9	4.0		
1959			1.8	2.4	3.0	3.8	4.6	
1960		1.5	1.8	2.1	2.8	4.3	6.5	
1961[3]		1.6	1.7	2.3	3.1	4.1		

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[1] Cottons used in preparing copies of standards are from crops of previous year or years; when trash on surface of samples from these bales does not match the standards, each copy is adjusted until it appears equal.

[2] Preliminary estimate based on data through Jan. 15.

[3] Preliminary estimate based on data through Dec. 31.

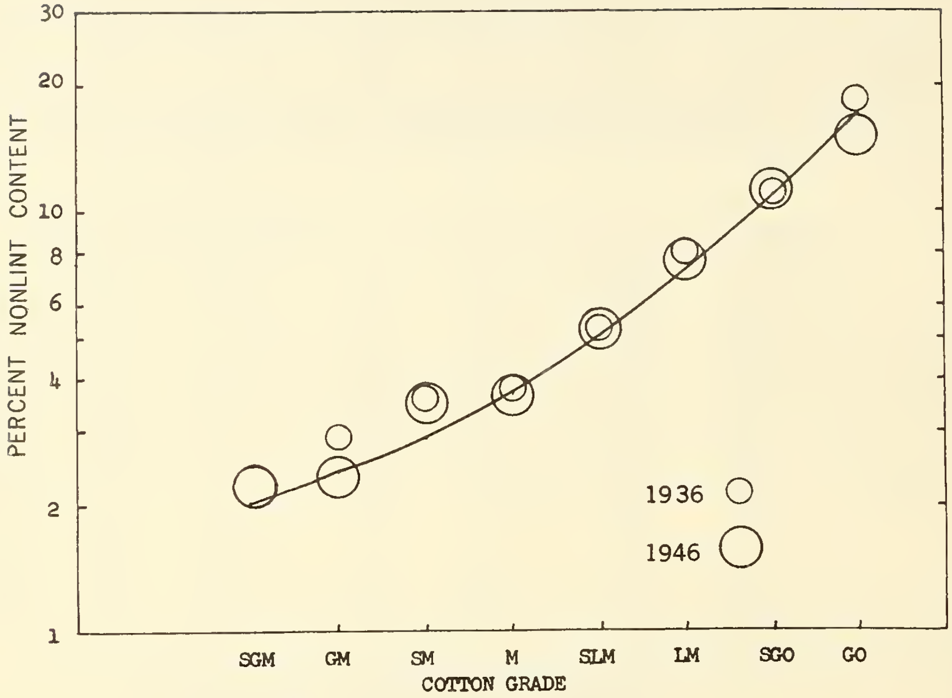

Fig. 1.--Percent Shirley Analyzer nonlint of bales used in 1936 and 1946 white grade standards. Curve based on them is target specification for standards.

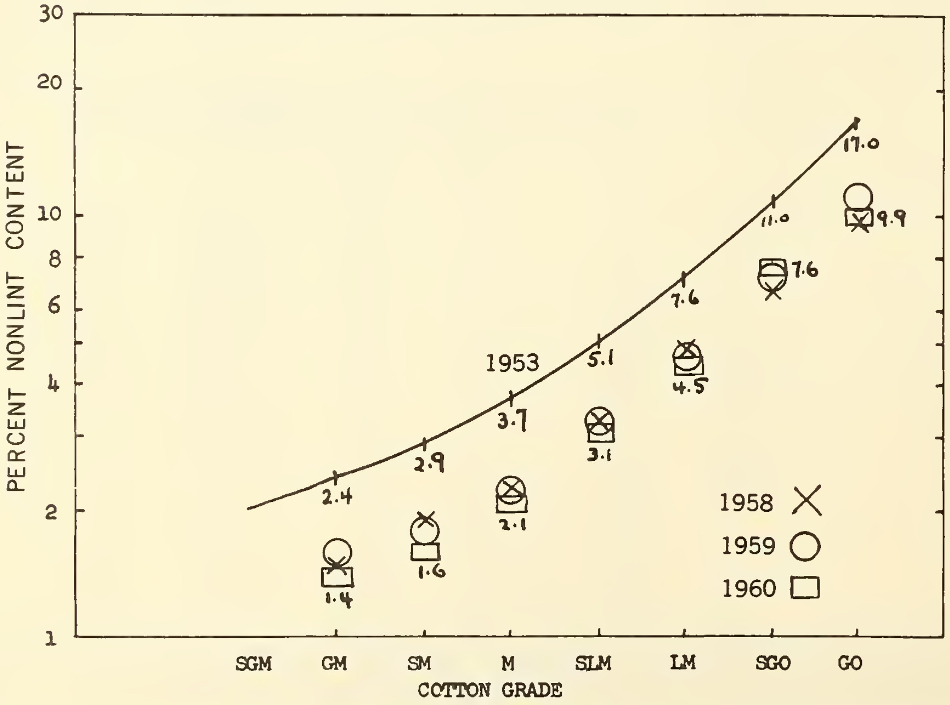

Fig. 2.--Decrease in trash content in recent cotton crops illustrated by data for 1958, 1959, 1960 crops in relation to curve for standards.

Data for manufacturing (picker and card) waste of white grades, taken from the Annual Quality Surveys published 1946 through 1960, are summarized in table 4. They provide a measure of trash that shows a trend similar to that for Shirley Analyzer nonlint content, but on a level about 5 percent higher, since mill waste includes considerably more fiber. Figures 3 and 4 illustrate the relationship between the measurements of nonlint and picker and card waste for 1946-7 and for 1960. Whether measured by Shirley Analyzer or by picker and card waste, this means that gins are doing a much better job at removing leaf today than they did before the days of mechanical harvesting. Bales leave the gin today with even less trash for any given lint color than in the days of hand harvesting! That this extra trash removed shows up in the same amount in both Shirley Analyzer and picker and card waste is evidenced by comparisons that can be made from table 5. In 1960 the decrease in trash amounted to about 1.5 percent for Middling and about 3.1 percent for Low Middling, whether measured by Shirley Analyzer or by picker and card waste.

Differences in terms of grade may not indicate the significance of these facts to some as much as if the same facts were put in another way. They mean that a mill that buys 100,000 bales of cotton would receive the equivalent of 1,500 more bales of lint today for Middling, than it would have received 10 years ago. Much of this is leaf content formerly baled with the lint, but now taken out before baling and shipping.

Throughout this discussion it should be kept in mind that while by weight there are differences of as much as two grades that exist between trash in cottons of today as compared to cottons of earlier years, this may overstate the case in terms of trash visible to the classer. Another point that should be made is that not only has the quantity of leaf changed these past few years, but the kind, for large leaf has almost disappeared in today's cottons, and a classer's impression of amount is considerably affected by this change. A lot of very small leaf looks like more than single large pieces, yet may not weigh nearly so much. The small leaf, however, is much more trouble to remove than single large pieces, so even if it is over-assessed in relation to weight, the visual judgment may in this case more nearly represent the value facts of trash than do the weight figures obtained on the Shirley Analyzer.

As brought out earlier, it is the relation of the three factors of color, trash, and preparation that has changed in the grades of today. Measurements of color and trash, for samples of normal preparation, provide a direct way to establish the grade, and if measurements could be made quickly and precisely for each factor separately, the problem would be easier to solve than now. Measurements of color include trash as well as lint. And the trash includes dust, which weighs very little in the Shirley Analyzer samples yet has a considerable effect on the color measurement. To get a measure of the lint color itself, a cotton sample must be cleaned of leaf and dust. Cotton put through the Shirley Analyzer, measured before and after cleaning, provides information on both color and trash. By a rough rule-of-thumb, in earlier years the improvement in color before and after cleaning on the Shirley Analyzer, for cottons with average leaf and color for any given grade, has been about one grade.

Table 4.--TRASH ANALYSIS: Measured by percent of picker and card waste of white grade samples

Year	Grades							
	SGM 2	GM 3	SM 4	M 5	SLM 6	LM 7	SGO 8	GO 9
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
	Average relationship used as guide for many years for comparing Annual Quality Survey results for medium staple cottons							
Guide	---	6.3	7.2	8.1	9.3	12.5	15.6	18.3
	Based on samples used in cotton quality surveys published annually since 1946							
1946			8.5	8.6	9.7			
1947			7.6	8.5	9.4	12.4		
1948		8.6	7.9	7.8	9.0	10.0	15.6	
1949		7.2	8.7	9.2	10.1	11.7		
1950			7.9	8.1	9.3	11.3		
1951			7.6	8.1	8.9	11.6	12.8	
1952		5.0	6.7	7.2	8.5	9.9		
1953		7.8	6.6	7.2	8.1	9.7	10.0	
1954		6.6	6.8	7.5	8.5	9.6		
1955			7.7	8.2	9.0	11.2		
1956		7.8	8.0	8.1	9.2	10.4		
1957		7.3	7.7	7.9	8.8	9.8	12.5	
1958			6.9	7.4	7.9	9.8		
1959			7.9	8.0	8.6	9.8	10.6	
1960		7.4	6.7	6.6	7.9	9.3	12.3	
	3-year averages, for comparison							
1946-8		8.6	8.0	8.3	9.4	11.2	15.6	
1953-5		7.2	7.0	7.6	8.5	10.2	10.0	
1958-60		7.4	7.2	7.3	8.1	9.6	11.4	

Table 5.--TRASH ANALYSIS BY GRADES: Differences for nonlint and for picker and card waste, by percent weight, for 1960 measurements compared to standard curves

	Grades							
	SGM 2	GM 3	SM 4	M 5	SLM 6	LM 7	SGO 8	GO 9
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
	Shirley Analyzer nonlint content							
1953 std. curve	2.0	2.4	2.9	3.7	5.1	7.6	11.0	17.0
1960 crop		1.4	1.6	2.1	3.1	4.5	7.6	9.9
Diff. in trash		-1.0	-1.3	-1.6	-2.0	-3.1	-3.4	-7.1
	Picker and card waste							
Guide curve - 1960		6.3	7.2	8.1	9.3	12.5	15.6	18.3
Annual Quality		7.4	6.7	6.6	7.9	9.3	12.3	---
Diff. in trash		+1.1	-0.5	-1.5	-1.4	-3.2	-3.3	---

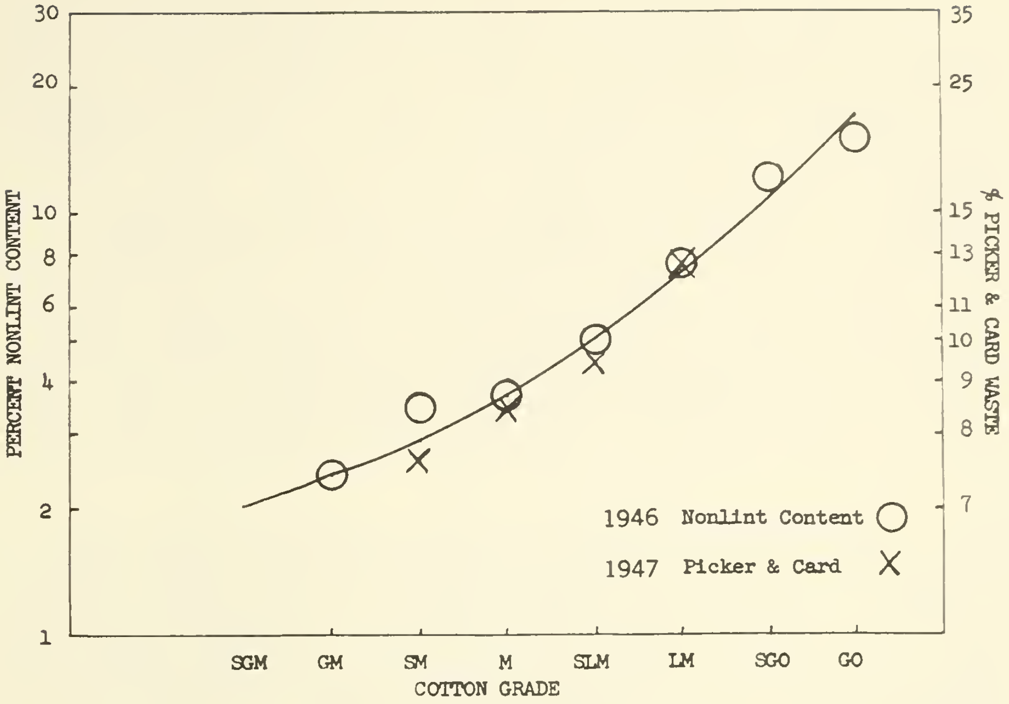

Fig. 3.--Level of trash analysis by Shirley Analyzer and by picker and card waste for 1946-1947 compared to standards curve. (Picker and card is 5 percent above S.A. scale.)

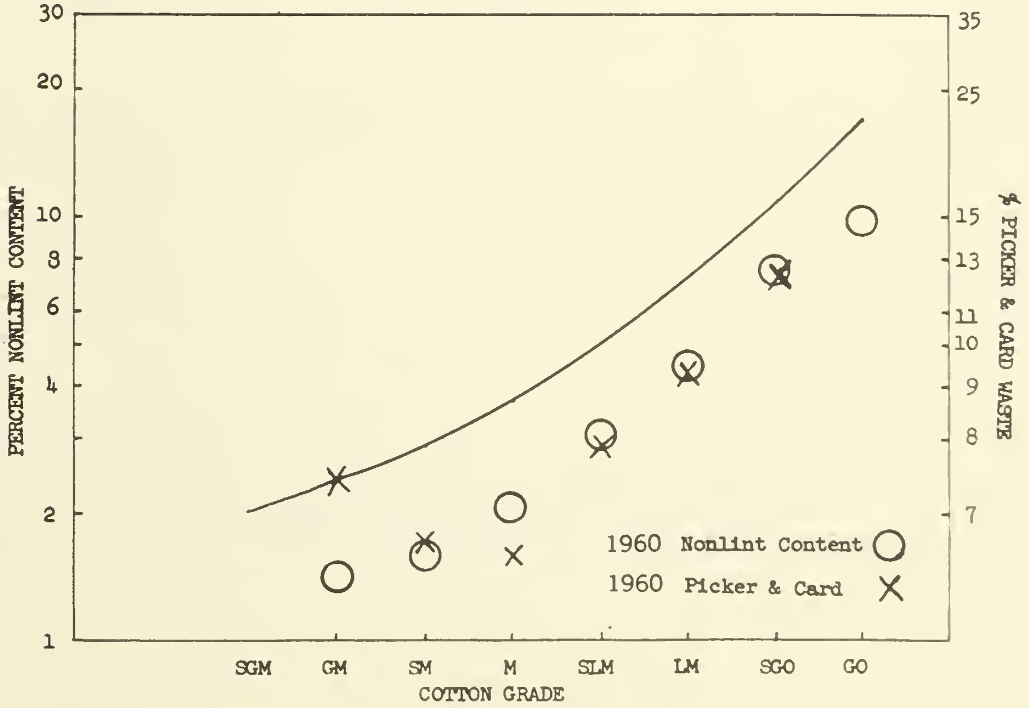

Fig. 4.--Level of trash analysis by Shirley Analyzer and by picker and card waste shows extent of decrease in trash content in 1960 crop compared to standards curve which fit in 1936, 1946, and 1953.

If cottons are put through so much cleaning at the gin that little or no leaf or dust remains to be taken out by the Shirley Analyzer, then there will be little difference in the color measurement of the before-and-after Shirley Analyzer samples. Thus, if a sample measures SLM average color before cleaning, and remains SLM average color after cleaning, it means that the color of the cleaned lint cotton is close to that which in earlier years would have been expected of LM, a grade lower cotton. On the other hand, if a cotton is machine-picked and does not have extra cleaning at the gin to compensate for this, the amount of trash left in it may be high. In such a case the color improvement in before-and-after Shirley Analyzer samples may be as much as two grades in color, for the trash could be equal to that of SGO, and the cleaned lint color equal to SLM. Since the cleaned-lint color is an indication of the amount of field exposure and all the damage associated with that exposure, it is important to know the degree of color improvement that is associated with any lowering of trash content.

Figure 5 demonstrates the amount of color difference, before and after cleaning on the Shirley Analyzer, for white cottons in three studies. These are shown on grade-color diagrams such as are used on the cotton colorimeter. Percent reflectance (the relative lightness or darkness of color) is plotted in a vertical direction, and the degree of yellowness in a horizontal direction. The grade diagram shown is limited to the white grades, the high grades toward the top, low grades toward the bottom. The amount of color difference before and after cleaning for cottons in grades Good Middling to Good Ordinary is illustrated by the length of the vectors. The color of samples before cleaning is plotted at the dashed line in the center of each grade group, and the arrows indicate the average amount of color improvement after cleaning for each grade in the years noted. Roughly speaking, the color improvement after cleaning seems to be about one grade for early years.

In 1958 it seemed as if a trend had started toward less color improvement in many of the grades, but by 1960, except for the high grade bales used in the 1961 standards, this seems to have reversed itself. Preliminary data for the 1961 crop confirm this reversal. They indicate almost the same color improvement today that occurred in early years when more leaf remained in the samples to be removed by the Shirley Analyzer. Since much of the color improvement is caused by removal of dust as well as leaf particles, it may be that in the period around 1958 cottons were so thoroughly cleaned that more of the dust was removed than is today.

If this were not so, and had the trend toward little color improvement in samples before and after cleaning on the Shirley Analyzer continued, it would have meant that cottons graded Middling would have lint color little better than cottons formerly graded Strict Low Middling. In other words, had the 1958 trend continued, and all the dust and dirt as well as leaf particles been removed, then any grade improvement caused by reduced amount of trash would have been offset by a lowering of lint color, which seems to have been true in 1958. And it is the lint color, and all factors associated with the degree of field exposure that caused its deterioration in color, that cannot be improved, either by the gin or by mill. (There is the exception that may seem to give a better color when light spots are blended throughout a bale so that after lint cleaning a bale may be classed White, whereas it would have been Light Spotted without the use of cleaners.)

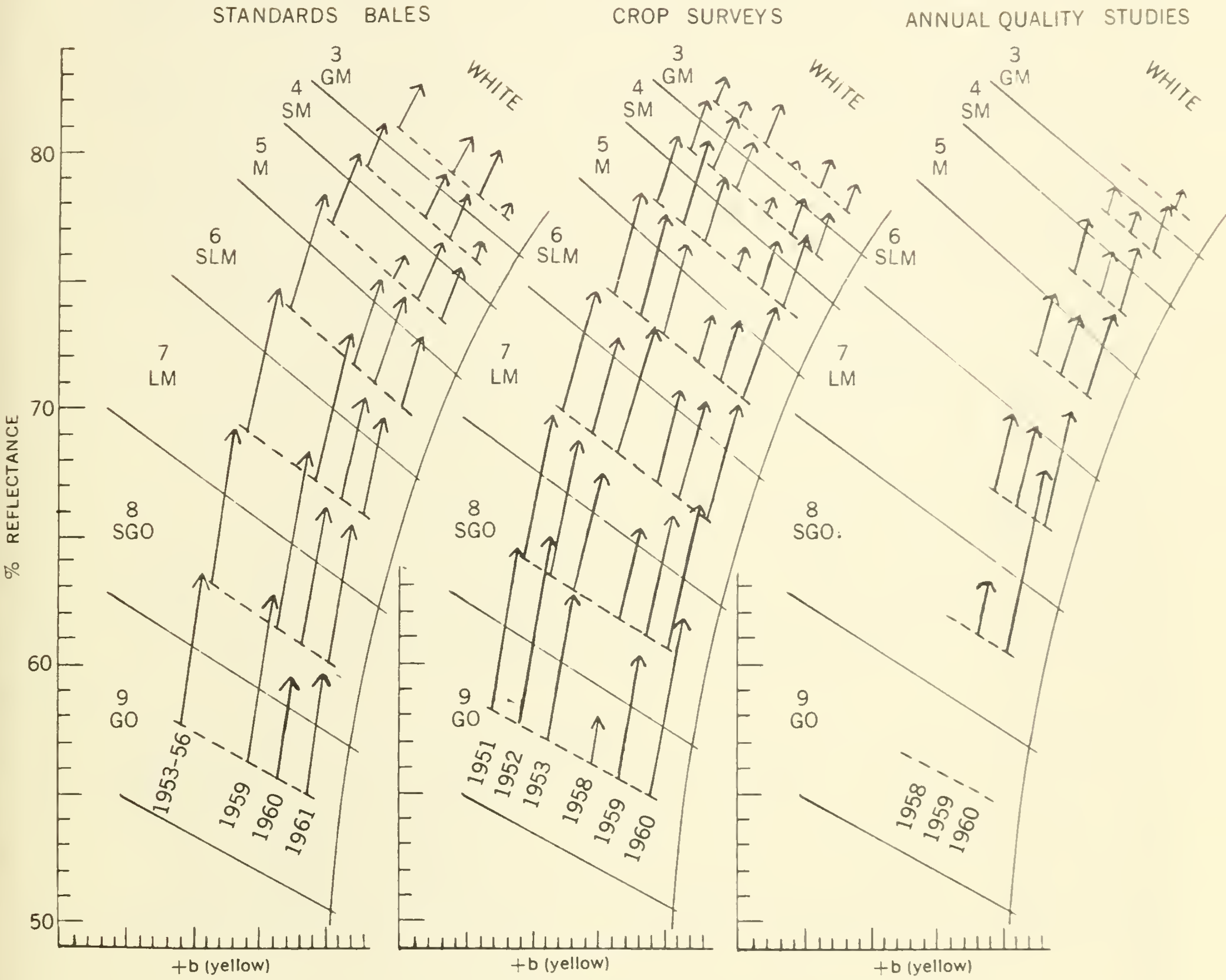

FIGURE 5.--COLOR CHANGE AFTER CLEANING ON THE SHIRLEY ANALYZER, FOR WHITE COTTONS IN STANDARDS BALES, CROP SURVEYS, AND ANNUAL QUALITY STUDIES, 1953-61.

The amount of color change is illustrated by length of vectors; color change caused by cleaning seems to average about one full grade, except that in 1958 there was less improvement in color than most other years. For standards use great care is taken to find bales matching the official standards as nearly as possible in all factors; when this fails, it is necessary to make leaf adjustment in preparing copies of the standards.

The trend toward lower color, that would offset any decrease in leaf, does not seem to be continuing in the bulk of today's cottons. But it is completely clear that relatively more leaf is being removed today from cottons of a given lint color, than was true a very few years ago. The facts are shown on table 3, and the cause quite clearly seems to be the increasing use of lint cleaners that has taken place in the past few years.

This poses a problem in standardization that must be faced. As long as grade covers more than one factor, any change that disturbs the relationship in effect when standards are established on a basis of any particular combination of factors, will make it necessary to average, or offset one factor against another, in applying those standards. The only method that will come even close to providing a basis for standards that can be permanent, and need no changing as the relationship between factors may change is to set scales for separate factors, and then either adopt some method for combining them in a single term, or report them as separate factors. In such a case the Grays could be eliminated, and guide boxes could be made available in which each sample could be labeled with the measurements of whatever separate factors it contained. If bales are not to be found in the crop with all factors of the same grade, then guide boxes for grade could contain samples marked with whatever combinations are found. Either this, or the standards should be changed to fit the color, leaf, and preparation combinations as they are represented in recent crops. While there may be some who may find an economic advantage in allowing the issue to remain confused, certainly it is in the public interest that standards be such that by their use the value of any cotton sample may be assessed as accurately as possible. Prices adjust themselves to the cotton no matter what it is called, and would undoubtedly do so in relation to any realistic change in standards that may be necessary.

It seems certain that no such method as the first one suggested will be adopted any time soon. It, too, would have its difficulties. But in these days of increasing instrumentation, the time is certain to come when standards will become a written specification, and be illustrated by guide boxes that can be measured in accord with standard specifications. Such cottons are available today in our check test program for establishing levels of measurements for testing cottons for fineness and strength, and these check cottons are quite as much a part of our cotton standardization program as the more familiar standards for grade and staple.

The fact that cottons are now being cleaned at the gin more thoroughly than in earlier years does not alter the color of fibers in any given sample. Cleaning out the leaf may make a sample look better in color than the fiber warrants, but it is the fiber color, not the amount of trash, that is an indication of the true worth of a sample. A Low Middling cotton, if it were cleaned of all its leaf and trash, is still a low grade cotton, and will run no better in a mill when the leaf and trash are taken out at the gin, than when they are taken out by the mill. On the other hand, if treated as well by the gin as by the mill in removing the trash, there is no reason why such a sample should run any worse in the mill, unless the mill thereafter "over-machines" it by putting it through cleaning processes that are no longer needed.

SUMMARY

In summary, visual examination for trash content is accomplished through use of grade standards. These combine in single samples the three separate factors of color, trash, and preparation. As long as standards for grade are not changed, these factors when judged separately are on the same level today that they have been for many years. But with a changed relationship of factors in the cottons of current crops, a sample called by a given grade name today may differ from a sample called by the same name yesterday.

Measurements show less trash in current crops than in earlier years. Compared to the grade standards, which were a good fit for 1953 and earlier crops, the trash content in 1960 for grades below Low Middling are more than 3 percent less trash or about one grade less; in Low Middling about 3 percent less trash which at that level means about 1.5 grades; in Strict Low Middling about 2.0 less trash which means two grades; and in Middling and above about 1.5 percent which can mean even more than two grades less trash. These are about the levels of additional trash taken out by use of one to two lint cleaners. Use of lint cleaners has increased rapidly since 1948 when they were found in only 28 gins; today they are found in over 5,000 of the 5,619 gins reported in the United States.

It is the relation of color, trash, and preparation in the cottons of today that has changed since 1953, the year when the present white grade standards became effective. Trash measurements, combined with color measurements made before and after cleaning on the Shirley Analyzer, can tell a great deal about the separate factors. If all trash and dust is cleaned out of a sample, the percentage of trash by Shirley Analyzer should approach zero, and the differences in color before-and-after Shirley Analyzer treatment will also approach zero. This would mean that all dust, as well as all leaf, is removed. And this is not the case. Trash measurements are decreasing but have by no means reached the zero stage, and differences in color before and after cleaning are now only very slightly less, though more erratic, than 8 or 10 years ago.

This difference in trash content creates a problem in standardization. As long as grade consists of more than one factor, anything that disturbs the relationship in effect when the original standards are established will make it necessary to change those standards when they become so difficult to apply that all segments of the trade finally become willing to face the need for changes. While the only permanent solution is establishment of standard scales for separate factors, the adoption more immediately of standards that will "reflect the characteristics of recent cotton crops, insofar as color, leaf, and preparation are concerned" seems necessary.

Prices are based on what is thought to be the value of a cotton sample, no matter how it is called. Standards that do not fit the crop merely increase the difficulty of describing cottons in terms by which their value can be accurately reflected. There is so much less trash in today's cottons than in yesterday's, that standards need changing in order to make it possible to describe grade factors, whether separate or combined, in terms that will no longer confuse, but once again will begin to reflect grade characteristics accurately enough so that the grade aspects of cotton value may be determined in a satisfactory way.